


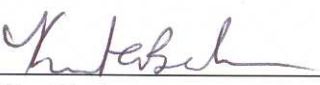



CRITERION 721

WET PIPE SPRINKLERS

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RECORD OF REVISIONS

Revision No.	Date	Description
0	08/27/98	Initial Issue
1	05/21/02	<p>This revision reflects the conversion from a WordPerfect document into a Microsoft Word document and additional clarification on how to develop criteria. This revision includes:</p> <ul style="list-style-type: none">• The addition of a Table of Contents,• The use of basis statements throughout.• Revision to Section 9, “Required Documents,” and further clarification in the use of references.• Changes to Section 4.0 to address O& M Criterion written by groups other than FWO-MSE.• Changes to clarify NFPA 25 ITM requirements.
	7/29/02	Incorporation of wording changes from FM Council in Section 6.0
2	08/04/03	<p>Revision of Sections 6.2 and 6.3 to clarify NFPA 25 requirements.</p> <p>Change of reference of DOE O 4330.4B to DOE O 433.1</p>

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CRITERION 721

WET PIPE SPRINKLERS

1.0 PURPOSE

The purpose of this Criterion is to establish the minimum requirements and best practices for operation, maintenance and inspection of wet pipe sprinklers at LANL.

This document addresses the requirements of LIR 230-05-01(Ref 10.1), "Operations and Maintenance Manual."

Implementation of this Criterion satisfies DOE Order 430.1A (Ref 10.2) for the subject equipment / system – DOE Order 430.1A (Ref 10.2) "Life Cycle Asset Management," Attachment 2 "Contractor Requirements Document," Paragraph 2, Sections A through C, which in part requires UC to "...maintain physical assets in a condition suitable for their intended purpose," and employ "preventive, predictive, and corrective maintenance to ensure physical asset availability for planned use and/or proper disposition." Compliance with DOE Order 430.1A is required by Appendix G of the UC Contract.

2.0 SCOPE

The scope of this Criterion includes the routine inspection, testing and preventive and predictive maintenance of wet pipe sprinkler systems. This Criterion does not address corrective maintenance actions required to repair or replace equipment.

3.0 ACRONYMS AND DEFINITIONS

3.1 Acronyms

AHJ	Authority Having Jurisdiction
CAS	Central Alarm Station
DOE	Department of Energy
FDC	Fire Department Connections
FWO	Facility Waste Operations
ITM	Inspection, Testing, and Maintenance
LIR	Laboratory Implementing Requirement
LPR	Laboratory Performance Requirement
MSE	Maintenance and Systems Engineering
O&M	Operations and Maintenance
PP&PE	Personal Property and Programmatic Equipment
RP&IE	Real Property and Installed Equipment

SSC	Structures, Systems, and Components
SSS	Support Services Subcontractor
UC	University of California

3.2 Definitions

Management Level Determination (ML1, ML2, ML3, ML4)-A classification system for determining the degree of management control applied to facility work. See LIR 230-01-02 for definitions of each ML level.

Wet Pipe Sprinkler System – A sprinkler system filled with water throughout the system piping (from water supply piping through control valve, main and branch sprinkler piping up to the system’s closed sprinklers). Actuation of the system occurs when ambient heat (for example, from a fire) causes a fusible element on a sprinkler to melt, resulting in opening the sprinkler, and releasing water on the source of the heat.

4.0 RESPONSIBILITIES

4.1 FWO- Maintenance and Systems Engineering (FWO-MSE)

4.1.1 FWO-MSE is responsible for the administrative content of this Criterion and monitoring the applicability and the implementation status of this Criterion and either assisting the organizations that are not applying or meeting the implementation expectations contained herein or elevating their concerns to the director(s).

Basis: LIR 301-00-01.11; Issuing and Managing Laboratory Operations Implementation Requirements and Guidance, Section 5.4, OIC Implementation Requirements.

4.1.2 FWO-MSE shall provide technical assistance to support implementation of this Criterion.

4.2 FWO-Fire Protection (FWO-FIRE)

4.2.1 FWO-FIRE is responsible for the technical content of this Criterion and monitoring the proper implementation across the Laboratory.

4.2.2 FWO-FIRE shall provide technical assistance to support implementation of this Criterion.

4.3 Facility Manager

4.3.1 Responsible for operations and maintenance of institutional, or Real Property and Installed Equipment (RP&IE) under their jurisdiction, in accordance with the requirements of this document.

4.3.2 Responsible for operations and maintenance of those Personal Property and Programmatic Equipment (PP&PE) systems and equipment addressed by this document that may be assigned to the FM in accordance with the FMU-specific Facility/Tenant Agreement.

4.4 Group Leader

4.4.1 Responsible for operations and maintenance of those Personal Property and Programmatic Equipment (PP&PE) or Real Property and Installed Equipment (RP&IE) systems and equipment addressed by this document that are under their jurisdiction.

4.4.2 Responsible for system performance and subsequent replacement or refurbishment of assigned PP&PE and RP&IE.

4.5 Support Services Subcontractor

4.5.1 Responsible for providing ITM of the fire protection systems addressed in this Criterion at the request of the responsible Facility Manager.

4.5.2 Responsible for coordinating work with operating group and Facility Manager to conduct ITM in the affected area.

4.6 Authority Having Jurisdiction (AHJ) – Fire Marshal

4.6.1 The AHJ is responsible for providing a decision on a specific technical question regarding this Criterion.

4.6.2 The LANL Fire Marshal is the approval authority for all exceptions and variances to this Criterion.

5.0 PRECAUTIONS AND LIMITATIONS**5.1 Precautions**

This section is not intended to identify all applicable precautions necessary for implementation of this Criterion. A compilation of all applicable precautions shall be contained in the implementing procedure(s) or work control authorization documents.

The following precautions are intended only to assist the author of a procedure or work control document in the identification of hazards/precautions that may not be immediately obvious.

5.2 Limitations

The intent of this Criterion is to identify the minimum generic requirements and recommendations for SSC operation and maintenance across the Laboratory. Each user is responsible for the identification and implementation of additional facility specific requirements and recommendations based on their authorization basis and unique equipment and conditions, (e.g., equipment history, manufacturer warranties, operating environment, vendor O&M requirements and guidance, etc.).

Nuclear facilities and moderate to high hazard non-nuclear facilities will typically have additional facility-specific requirements beyond those presented in this Criterion. Nuclear facilities shall implement the requirements of DOE Order 433.1 (Ref. 10.3) as the minimum programmatic requirements for a maintenance program. Additional requirements and recommendations for SSC operation and maintenance may be necessary to fully comply with the current DOE Order identified above.

6.0 REQUIREMENTS

Minimum requirements that Criterion users shall follow are specified in this section. Requested variances and exceptions to these requirements shall be prepared and submitted to FWO-MSE in accordance with LIR 301-00-02 (Ref. 10.4), "Variances and Exceptions to Laboratory Operations Requirements," for review and approval. The Criterion users are responsible for analysis of operational performance and SSC replacement or refurbishment based on this analysis. Laws, codes, contractual requirements, engineering judgement, safety matters, and operations and maintenance experience drive the requirements contained in this section. Variances and exceptions to this Criterion shall be approved by the LANL Fire Marshal.

6.1 Operations Requirements

6.1.1 Operations Checklist

The wet pipe sprinkler system shall remain operational at all times. The wet pipe sprinkler system shall be deemed operational when the following conditions are met:

- control valve is in the open position,
- water flow alarm is operational,
- sprinkler heads are unobstructed (ref. NFPA 13, Section 5-6),

- continuous or non-continuous obstructions such as storage and partial-height partitions are at least 18” below sprinkler deflectors;
- where fixed continuous or non-continuous obstructions beneath sprinklers are more than 48” wide [ex., scaffold, platforms, ductwork, cable trays, cutting tables], sprinklers must be provided underneath;
- where intermediate sprinklers might be cooled by sprinklers located above, the intermediate level sprinklers are equipped with spray shields;
- sprinklers are a sufficient horizontal distance from ceiling-height obstructions so that sprinkler spray pattern is not significantly obstructed (use engineering judgment and refer to NFPA 13 for restrictions)
- pendent and upright sprinklers are at least 4” from wall
- pipings, fittings, hangers, sprinklers, and other components are in their proper locations and in good repair, and
- and adequate water supply is available (with appropriate water pressure and quantity – compare to previous satisfactory test results).

Basis: NFPA 25, 2002 Edition Standard for the Inspection, Testing, and Maintenance of Water-based Fire Protection Systems Maintenance Requirements. Compliance with this NFPA code is required per Appendix G of the UC contract.

6.2 Maintenance Requirements

6.2.1 Quarterly Inspections

Sprinkler pressure reducing control valves shall be inspected quarterly to verify that the valves are in the following condition:

- In the open position.
- Not leaking.
- Maintaining downstream pressure in accordance with the design criteria.
- In good condition, with handwheels installed and unbroken.

Basis: NFPA 25, 2002 Edition Standard for the Inspection, Testing, and Maintenance of Water-based Fire Protection Systems Maintenance Requirements. Compliance with this NFPA code is required per Appendix G of the UC contract.

6.2.2 Semi-Annual Inspection

- (a) Visually inspect the system hydraulic nameplate, if provided, to ensure it is securely attached and legible.

NOTE: The nameplate may contain hydraulic calculation information applicable to the sprinkler system. If the sprinkler riser does not have a nameplate, this requirement is not applicable.

(b) Visually inspect system valves to verify the following:

- They are accessible.
- They are in their proper position.
- They are in good condition and free of external leaks.
- They are sealed, locked, or supervised.
- They are properly identified.

(c) Visually inspect system alarm devices to verify that they are accessible, in good condition, and free of damage.

(d) Visually inspect system gauges to verify that they have up-to-date calibration and that they are displaying normal supply-side and system-side pressures.

(e) Visually inspect FDCs to verify the following:

- FDCs are visible and accessible,
- Couplings or swivels are undamaged and rotate smoothly,
- Plugs and caps are in place and undamaged,
- Interior of the connection is unobstructed and valve clapper is operational over its full range when the FDC is plugged or if caps are out of place,
- Gaskets are in place and in good condition,
- Identification signs are in place,
- Check valve is not leaking,
- The automatic drain valve is in place and operating properly,
- Components are cleaned, repaired, or replaced as necessary in accordance with the manufacturer's instructions, and
- FDC clapper(s) is in place and operating smoothly.

Basis: NFPA 25, 2002 Edition Standard for the Inspection, Testing, and Maintenance of Water-based Fire Protection Systems Maintenance Requirements. Compliance with this NFPA code is required per Appendix G of the UC contract. DOE-approved Equivalency to NFPA 25.

6.2.3 Annual Inspection

- (a) Visually inspect the entire system (piping and fittings, seismic bracing, hangers, sprinkler heads including spares, sprinkler obstructions, and unprotected spaces) to verify operability and to ensure the system is free of mechanical damage.
 - Pipe, fittings, hangers, and seismic braces installed in concealed spaces such as above suspended ceilings shall not require inspection.
 - Pipe and hangers installed in areas that are inaccessible for safety considerations due to process operations shall be inspected during each scheduled shutdown.
- (b) The supply of spare sprinklers shall be inspected for:
 - The proper number and type of sprinklers.
 - A sprinkler wrench for each type of sprinkler.

Basis: NFPA 25, 2002 Edition Standard for the Inspection, Testing, and Maintenance of Water-based Fire Protection Systems Maintenance Requirements. Compliance with this NFPA code is required per Appendix G of the UC contract.

6.2.4 5-Year Inspections

- (a) Internally inspect all alarm valves every 5 years until tests indicate a greater frequency is necessary.
- (b) Visually inspect all check valves internally every 5 years to verify components operate properly, move freely, and are in good condition. Clean, repair or replace the internal components as necessary in accordance with the manufacturer's instructions.
- (c) Internally inspect strainers, filters, and restricted openings every 5 years unless tests indicate that a more stringent frequency is required.

Basis: NFPA 25, 2002 Edition Standard for the Inspection, Testing, and Maintenance of Water-based Fire Protection Systems Maintenance Requirements. Compliance with this NFPA code is required per Appendix G of the UC contract.

6.3 Testing**6.3.1 Quarterly Testing**

Systems where the sole water supply is through a back flow preventer and/or pressure reducing valves, the main drain test of at least one system downstream of the device shall be conducted on a quarterly basis.

Basis: NFPA 25, 2002 Edition Standard for the Inspection, Testing, and Maintenance of Water-based Fire Protection Systems Maintenance Requirements. Compliance with this NFPA code is required per Appendix G of the UC contract.

6.3.2 Semiannual Testing [twice per year]

- Test system alarms.
- Conduct a main drain test.

Basis: NFPA 25, 2002 Edition Standard for the Inspection, Testing, and Maintenance of Water-based Fire Protection Systems Maintenance Requirements. Compliance with this NFPA code is required per Appendix G of the UC contract.

6.3.3 Annual Testing

- Fully close and reopen the system control valve(s).
- Test any antifreeze solution for the design freeze point before the onset of winter or the first freeze.
- Pressure reducing or relief valves – A partial flow test adequate to move the valve from its seat shall be conducted annually.

Basis: NFPA 25, 2002 Edition Standard for the Inspection, Testing, and Maintenance of Water-based Fire Protection Systems Maintenance Requirements. Compliance with this NFPA code is required per Appendix G of the UC contract.

6.3.4 Other Testing Time Frames

- (a) Every 5 years, replace gauges or test by comparison to a calibrated gauge and adjust to bring into acceptable calibration.
- (b) (See Appendix A, Sprinkler Testing Requirements for specific requirements.)
- (c) Pressure reducing or relief valves: A full-flow test shall be conducted at 5-year intervals and shall be compared to previous test results.

Basis: NFPA 25, 2002 Edition Standard for the Inspection, Testing, and Maintenance of Water-based Fire Protection Systems Maintenance Requirements. Compliance with this NFPA code is required per Appendix G of the UC contract.

6.4 Maintenance**6.4.1 General**

Ensure all system components are working. Repair or replace any components that fail a test or inspection in accordance with the manufacturer's instructions.

6.4.2 Sprinklers:

- (a) Replacement sprinklers shall have the appropriate characteristics for the application intended. These characteristics shall include proper:
 - style,
 - orifice size and K factor,
 - temperature rating,
 - coating (if any),
 - deflector type (e.g., upright, pendant, sidewall), and
 - design requirements.
 - Use only new, listed sprinklers as replacements.
- (b) LANL's Support Service Subcontractor shall keep a supply of at least six spare sprinklers (proportionally representative of the types and temperature ratings of system sprinklers) for replacement purposes.
- (c) Protect sprinklers covering spray-coating areas against overspray residue.
- (d) Conduct an obstruction investigation for sprinkler systems and yard main piping whenever any of the following conditions exist:
 - plugged piping in sprinkler systems dismantled during building alterations are discovered,
 - failure to flush yard piping or surrounding public mains following new installations or repairs,
 - record of broken public mains in the vicinity exists,
 - abnormally frequent false tripping of a dry pipe valve(s),
 - there is reason to believe that the sprinkler system contains sodium silicate or highly corrosive fluxes in copper systems,
 - a system has been supplied with raw water via the fire department connection,
 - pinhole leaks are found, and

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- there is a 50-percent increase in the time it takes water to travel to the inspector's test connection from the time the valve trips during a full flow trip test of a dry pipe sprinkler system when compared to the original system acceptance test.
- discharge of obstructive materials is found during routine water flow tests.
- foreign materials are discovered in fire pumps or check valves.
- heavy discoloration of water during drain tests or plugging of inspectors test connection is found.
- plugging of sprinklers is discovered.
- following repair of water mains in the vicinity.
- a system is returned to service after an extended period (normally greater than 1 year).

Basis: NFPA 25, 2002 Edition Standard for the Inspection, Testing, and Maintenance of Water-based Fire Protection Systems Maintenance Requirements. Compliance with this NFPA code is required per Appendix G of the UC contract.

6.4.3 Control Valves

- Annually lubricate the operating stems of outside screw and yoke (OS&Y) valves. Then close and reopen the valve completely to test its operation and distribution of the lubricant. Graphite lubricant is recommended.

NOTE: Do not apply grease or other sealing materials to the seating surfaces of valves.

- Clean, repair, or replace internal components as needed in accordance with the manufacturer's instructions and deemed by inspection.

Basis: NFPA 25, 2002 Edition Standard for the Inspection, Testing, and Maintenance of Water-based Fire Protection Systems Maintenance Requirements. Compliance with this NFPA code is required per Appendix G of the UC contract.

6.5 Impairments and Modifications

If one or more of the operations requirements listed in Section 6.1.1 are not maintained, follow the actions outlined in Criterion 733, Fire Protection System Impairment Control Program.

6.5.1 Inspection (After an Impairment or Modification)

Visually inspect the system before returning it to service (See Appendix B, Visual Inspection After Repair Checklist)

6.5.2 Testing (After an Impairment or Modification)

- Check the water supply to verify an adequate pressure and volume of water is available at the system connection.
- Test the main drain to verify the control valve is open.
- Test using the inspector's test connection to verify the system's local audible alarm and/or alarm signal to the Central Alarm Station will operate within the required time.
- Flush (if required by NFPA 13) and hydrostatically test any repaired or modified parts of the system before returning it to service (pressure boundary or flow path).

Basis: NFPA 25, 2002 Edition Standard for the Inspection, Testing, and Maintenance of Water-based Fire Protection Systems Maintenance Requirements. Compliance with this NFPA code is required per Appendix G of the UC contract.

6.5.2.1 Operational testing and alarm verification will be conducted by SSS personnel, in compliance with LIR 402-910-01, Section 6.0.

Basis: LIR 402-910-01, LANL Fire Protection Program

7.0 RECOMMENDATIONS AND GOOD PRACTICES

The information provided in this section is recommended based on acceptable industry practices and should be implemented by each user based on his/her unique application and operating history of the subject systems/equipment.

7.1 Operations Recommendations

There are no operational recommendations for this Criterion.

7.2 Maintenance Recommendations**7.2.1 Persons other than SSS Fire Protection Maintenance personnel may conduct visual inspection requirements identified in this document.**

8.0 GUIDANCE

8.1 Operations Guidance

No operations guidance available.

8.2 Maintenance Guidance

No maintenance guidance available.

9.0 REQUIRED DOCUMENTATION

Maintenance history shall be maintained by the FM for wet pipe sprinklers to include, as a minimum, the parameters listed in the Table 9-1 below:

Table 9-1 Documentation Parameters

MAINTENANCE HISTORY DOCUMENTATION PARAMETERS				
PARAMETER	ML 1	ML 2	ML 3	ML 4
Wet Pipe Sprinkler System Maintenance Activities				
Repair / Adjustments	X	X	X	X
PM Activities	X	X	X	X
Wet Pipe Sprinkler System Equipment Problems				
Failure Dates	X	X	X	X
Failure Root Cause	X	X	X	X
Wet Pipe Sprinkler System Inspection Results (per this Criterion)				
Inspection Date	X	X	X	X
SSC Condition	X	X	X	X

Basis: Documentation of the parameters listed in Table 9-1 above satisfies the requirements of LPR 230-07-00, Criteria 2, (Ref. 10.5) which states; “Maintenance activities, equipment problems, and inspection and test results are documented.”

10.0 REFERENCES

The following references, and associated revisions, were used in the development of this document.

10.1 DOE O 430.1A, Attachment 2 “Contractor Requirements Document” (Paragraph 2, Sections A through C), a requirement of Appendix G of the UC Contract.

10.2 DOE Order 433.1, Maintenance Management Program for Nuclear Facilities.

10.3 LIR 230-01-02.2, Graded Approach for Facility Work

10.4 LIR 230-05-01.0, Operations and Maintenance Manual.

10.5 LIR 301-00-02.0, Variances and Exceptions to Laboratory Operation Requirements.

10.6 LIR 402-910-01.4, LANL Fire Protection Program

10.7 LPR 230-07-00, Maintenance History, Performance Criteria [2].

10.8 NFPA 25, 1998 Edition Standard for the Inspection, Testing and Maintenance of Water-based Fire Protection Systems.

11.0 APPENDICES

Appendix A: Sprinkler Testing Requirements

Appendix B: Visual Inspection After Repair Checklist

Appendix A

Sprinkler Testing Requirements

(Basis: NFPA 25, 1998 Edition Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems)

1. Where required below, sample sprinklers shall be submitted to a recognized testing laboratory acceptable to the authority having jurisdiction for field service testing.
 - Where sprinklers have been in service for 50 years, they shall be replaced or representative samples from one or more sample areas shall be tested. Test procedures shall be repeated at 10-year intervals.
 - Sprinklers manufactured using fast-response elements that have been in service for 20 years shall be tested. They shall be retested at 10-year intervals.
 - Representative samples of solder-type sprinklers with a temperature classification of extra high 163°C (325°F) or greater that are exposed to MSEi-continuous to continuous maximum allowable ambient temperature conditions shall be tested at 5-year intervals.
 - Where sprinklers have been in service for 75 years, they shall be replaced or representative samples from one or more sample areas shall be submitted to a recognized testing laboratory acceptable to the authority having jurisdiction for field service testing. Test procedures shall be repeated at 5-year intervals.
 - Dry sprinklers that have been in service for 10 years shall be tested or replaced. If maintained and serviced, they shall be retested at 10-year intervals.
 - Where sprinklers are subjected to harsh environments, including corrosive atmospheres and corrosive water supplies, on a 5-year basis, sprinklers shall either be replaced or representative sprinkler samples shall be tested.
 - Where historical data indicates, longer intervals between testing shall be permitted.
2. A representative sample of sprinklers for testing per 1 above shall consist of a minimum of not less than 4 sprinklers or 1 percent of the number of sprinklers per individual sprinkler sample, whichever is greater.
3. Where one sprinkler within a representative sample fails to meet the test requirement, all sprinklers represented by that sample shall be replaced.

Appendix B

Visual Inspection After Repair Check List

1. Inspect piping and joints for proper alignment.
2. Ensure material and method of repair is acceptable.
3. Check the system for leaks.
4. Ensure pipe hangers are adequate.
5. If sprinkler heads were replaced, ensure the type and temperature ratings meet the original specifications.